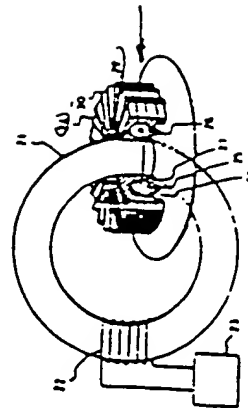


B3

(54) GENERATING METHOD OF HIGH PRESSURE PLASMA ARC
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 (71) FUJII DENPA KOKI K.K. (72) RYUICHI SHIMADA
 (51) Int. Cl. H05H1/46

PURPOSE: To generate high pressure plasma arc electrodelessly by generating plasma by means of applying high frequency voltage in a condition the gas pressure in furnace is sufficiently lowered, and then by retaining the plasma current and gradually increasing the pressure in furnace at the same time.

CONSTITUTION: In a condition the gas pressure in a hollow part 25 is sufficiently lowered so as to electrodeless discharge is easily performed, an induction field is generated from a high frequency oscillator 23 through a transformer core 21, according to the principle of transformer, and high frequency voltage is applied to a discharge tube 24 so as to generate a toroidal plasma. Then, as applying high frequency voltage, by retaining the plasma current and gradually increasing the gas pressure in the hollow part 25 at the same time, high pressure plasma arc is generated. Air current is rotated so as to offset plasma buoyancy generated at high pressure, and the plasma is thus generated near the center of the hollow part 25 stably for a long time.



22: primary coil, 24: glass container, 25: inlet tube, 26: discharge tube, 27: polepiece, magnetic field coil, 28: toroidal magnetic field coil

① 日本国特許庁(JP)

② 特許出願公開

③ 公開特許公報(A) 平2-260399

④ Int. Cl.

H 05 H 1/46

⑤ 特許番号

⑥ 特許出願番号

7458-2G

⑦ 公開 平成2年(1990)10月23日

審査請求 未請求 請求項の数 2 (全4頁)

⑧ 発明の名称 高圧プラズマアーク発生方法

⑨ 特 許 平1-78383

⑩ 出 願 平1(1989)3月31日

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明 細 書

1. 発明の名称

高圧プラズマアーク発生方法

2. 発明の要旨

(1) 高圧プラズマの発生び光を利用して、金属、非金属の両者を分離する高圧プラズマアークにおいて、管内のガス圧力を十分に上げた状態で高圧電圧を印加しプラズマを発生させた後、そのプラズマ電流を遮断したまま管内電圧を徐々に上昇させることによって、高圧プラズマアークを発生することを特徴とする高圧プラズマアーク発生方法。

(2) 高圧プラズマアークとして、高圧プラズマをトランス形式にて高圧電圧電圧させることにより、電極からの熱損失と電極の消耗をなくした高圧プラズマアークを用いることを特徴とする請求項1記載の高圧プラズマアーク発生方法。

3. 発明の具体的な説明

(産業上の利用分野)

本発明は高圧プラズマの発生び光を利用して、

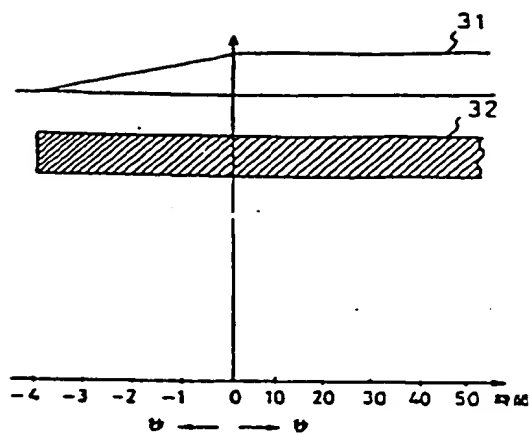
金属、非金属の両者を分離を行う高圧プラズマアークを用いた高圧プラズマアーク発生方法の改良に関する。

(従来の技術)

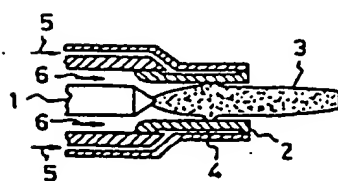
高圧プラズマの応用は、その光、熱を利用して照明、加熱アーク炉、アーク溶接等があり、その用途を益々、高圧をうまく利用することが重要である。

高圧プラズマはどのような高圧電圧でも発光的に完全のスペクトルに到達する、という能力があり、高圧プラズマの応用の一つとして高圧電圧電圧分離が考えられる。例えばPCの分離とかフロン電圧分離等がそれである。

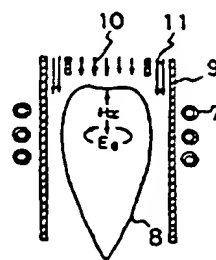
一万多くの研究機関が研究されているが電力多消費プロセスとなるのが最大の欠点とされてきた。しかし、特に高圧高電圧電圧領域(5000V以上)では、ほかでは得られない高電圧を発生するという特徴がある。その電圧を最大限利用して、高圧電圧電圧分離を作ることが出来る。プラズマの電圧を発生のアークより高くして、2万V以上にし、



第 2 図



第 3 図



第 4 図

(19) Japan Patent Office (JP)

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1990/10/23

(51) Int. Cl.⁵ H05H 1/46 Identification symbol

Reference number in Patent Office 7458-2G

Part of Technical indication

Request of Examination Unrequest Number of requests 2 (all 4 pages)

(54) Name of the invention

Method of generating high-pressure plasma arc

(21) Application Number: 1-78383

(22) Date of Application: 1989/3/31

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10-3-404 Daimaru, Midori-ku, Yokohama-shi, Kanagawa Pref.

(71) Applicant: FUJI DENPA KOKI K.K.

6-2-22 Fujimi, Tsurugashima-shi, Saitama Pref.

(74) Agent: Lawyer TAKEHIKO SUZUE and three more

PURPOSE: To generate high pressure plasma arc electrodelessly by generating plasma by means of applying high frequency voltage in a condition the gas pressure in furnace is sufficiently lowered, and then by retaining the plasma current and gradually increasing the pressure in furnace at the same time.

CONSTITUTION: In a condition the gas pressure in a hollow part 25 is sufficiently lowered so as to electrodeless discharge is easily performed, an induction field is generated from a high frequency oscillator 23 through a transformer core 21, according to the principle of transformer, and high frequency voltage is applied to a discharge tube 24 so as to generate a toroidal plasma. Then, as applying high-frequency voltage, by retaining the plasma current and gradually increasing the gas pressure in the hollow part

25 at the same time, high pressure plasma arc is generated. Air current is rotated so as to offset plasma buoyancy generated at high pressure, and the plasma is thus generated near the center of the hollow part 25 stably for a long time.

Detailed statement

1. Name of invention

Method of generating high-pressure plasma arc

2. Limits of patent requests

(1) M

(2) The method of generating high pressure plasma arc in a high temperature plasma arc furnace to decompose organic and inorganic harmful materials using heating and light emission from the high pressure plasma by the followed procedure: First, the plasma is generated by applying high-frequency voltage in low gas pressure. After that, the high pressure plasma arc is generated by gradually increasing the gas pressure with sustaining the plasma power.

(2) The method of generating the high pressure plasma arc shown above (request (1)) in a high temperature plasma arc furnace, where electrodeless plasma is generated with the "torrus" shape of high pressure arc so that heat loss from the electrodes or the consumption of the electrodes is eliminated.

3. Detailed explanation of invention

Field of use in industry: This invention is related to the improvement of the method of high pressure plasma arc generation in a high temperature plasma arc furnace, where organic and inorganic harmful materials are decomposed by utilizing the heat and the light emission from the high pressure plasma.

Conventional technique: There are applications of heat plasmas such as light source, arc furnace for steel manufacture, arc welding, etc. utilizing the light and the heat from the plasma, where it is important to well utilize the plasma controllability and high temperature.

Plasma has an ability to finally destroy any poisonous wastes to elements level. Therefore, the decomposition of industrial wastes is considered one of the applications

of plasma furnaces. For example, the decomposition of PCB and Fluorocarbon, etc. Although many research results have been reported, the largest problem has been that this process consumed a lot of electric power. However, the plasma has a feature to generate high temperature, which is difficult to be obtained with the other methods, especially in high temperature ($> 5000\text{ }^{\circ}\text{C}$) and high density region. Utilizing this feature, it is possible to make a special ultra-high temperature furnace.

(I am missing page 608.)

Page 609.

After that, high pressure plasma arc is generated by gradually increasing the gas pressure in the hollow part 25 with sustaining the plasma current by applying high-frequency voltage. At this moment, the plasma buoyancy, which is generated at high pressure, is canceled by rotating the gas flow, and the plasma is generated at the center of the hollow part 25 stably for a long time. Therefore, it is possible to generate a high pressure plasma in a "torus" shape without electrodes and eliminate the heat loss from the electrodes and consumption of the electrodes.

It is necessary to increase the current density in order to make the high temperature arc. Therefore, it is necessary to decrease the radius of current path and increase the pressure. High pressure is also useful to increase the gas temperature by reducing the difference between the electron temperature and the ion temperature.

Conventionally, it was impossible to generate an electrodeless, "torus" shaped plasma in high pressure gas, because high voltage is required between the two electrodes enough to break down the high pressure gas and obtain high pressure plasma arc. Therefore, the plasma arc furnace related to this invention consists of a "torus" shaped chamber having pressure controllability, a transformer core to generate inductive field according to the principle of a transformer and a high-frequency oscillator.

Effectiveness of the invention

As mentioned above, this invention gives an electrodeless plasma which can be operated continuously without consumption parts such as electrodes in a high

temperature plasma arc furnace, and an efficient high temperature furnace can be provided.

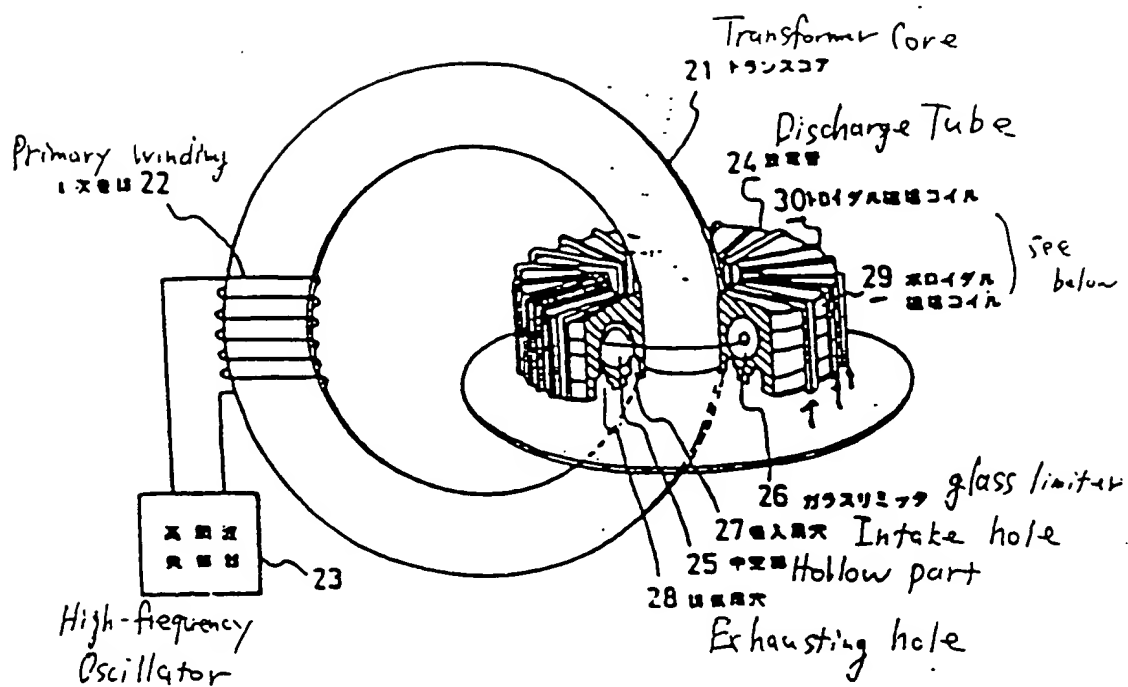
Simple explanations of the drawings

Figure 1 shows the structural view of an example of implementation using this invention. Figure 2 shows the characteristics of the gas pressure and the output of the high-frequency oscillator related to this invention. Figure 3 shows the cross section of the electrode structure of a typical DC plasma torch conventionally used. Figure 4 shows the structural cross section of the principle of high-frequency plasma generation. 21: transformer core, 22: primary winding, 23: high-frequency oscillator, 24: discharge tube, 25: hollow part, 26: glass limiter, 27: intake hole, 28 exhausting hole.

成を高める
り、気圧を
オシロスコ
も気圧を高

大気圏、
25...中気
...人用大、

凡 示 図



第 1 図
Figure 1

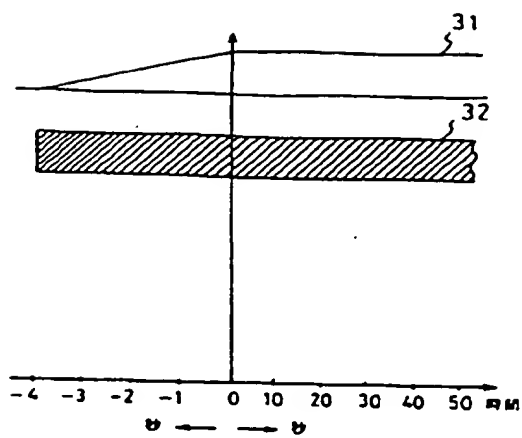
図 1 図は本発明の一実施例を示す構成図。図 2 図は本発明に係るガス圧力特性及び真空度特性の出力特性の一例を示す特性図。図 3 図は従来の真空管の D.C. プラズマトーチの構造図を示す断面図。図 4 図は本発明のプラズマトーチの構造図を示す断面図。

30 Toroidal Magnetic Field Coil

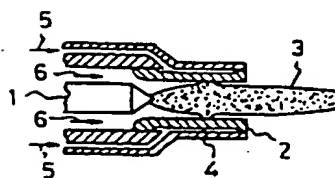
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Boroidal Magnetic Field Coil

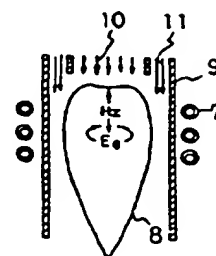
or
Perroidal



第 2 図



第 3 図



第 4 図